# WINCOMM UAT
# Laboratory Test Activities

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# Motivation

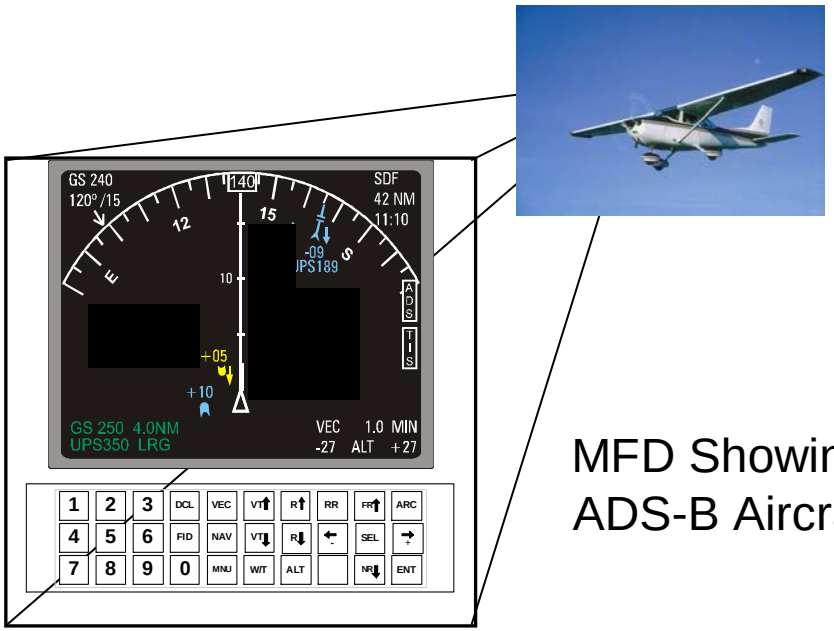
- The Aviation Safety and Security Program (AvSSP) of NASA formed Weather Information Communications (WINCOMM) to reduce aircraft accidents through high quality and timely dissemination of NAS weather and status information to in-flight aircraft.
- WINCOMM contains two distinct parts to accomplish this goal:
  - Uplink of Flight Information Services (FIS) information from the ground to aircraft
  - Aircraft broadcast of weather data from on-board sensors to other aircraft as well as the ground infrastructure
- These activities are focused on use of the Universal Access Transceiver (UAT) datalink only

# Automatic Dependent Surveillance – Broadcast (ADS-B) Background

- ADS-B Broadcasts Include
  - Identification
    - Flight ID
    - ICAO Address
  - Altitude
  - Latitude/Longitude
  - Velocity
  - Navigation Uncertainty
  - Climb or Descent Rate
  - Heading
  - Aircraft Category
- Focused on GA and regional aircraft

# Automatic Dependent Surveillance – Broadcast Background

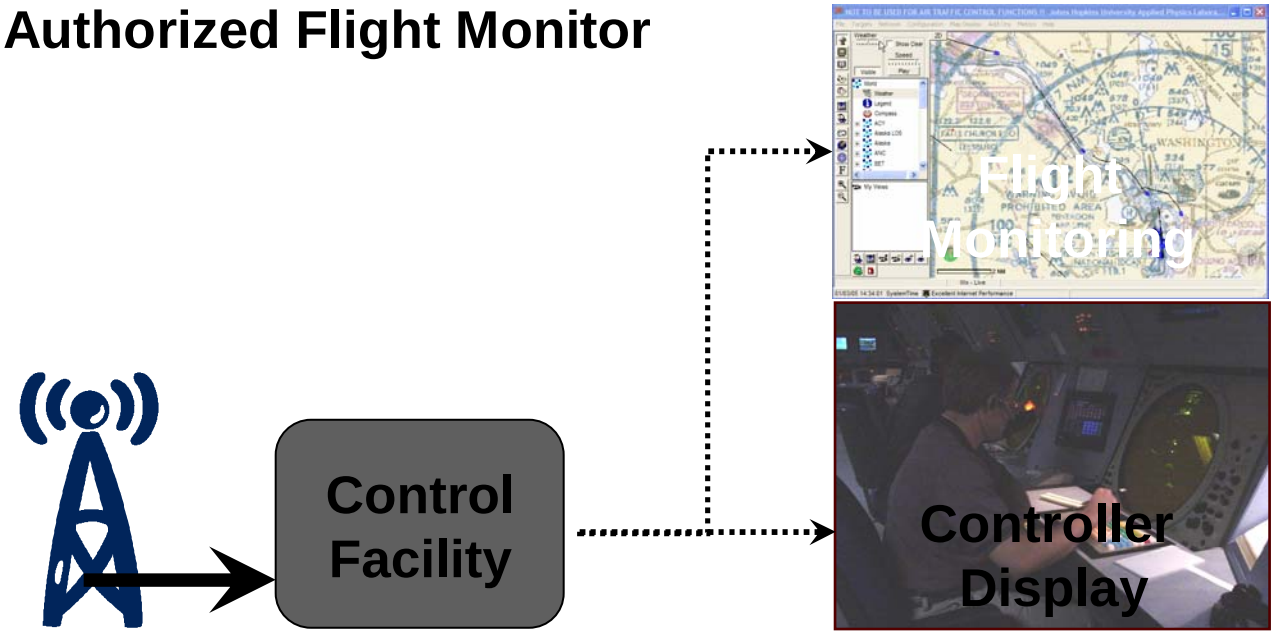
- **ADS-B Broadcasts**
  - **Detected by ADS-B Equipped Aircraft**
  - **Presented to Pilots on a Multifunction Display**




MFD Showing
ADS-B Aircraft

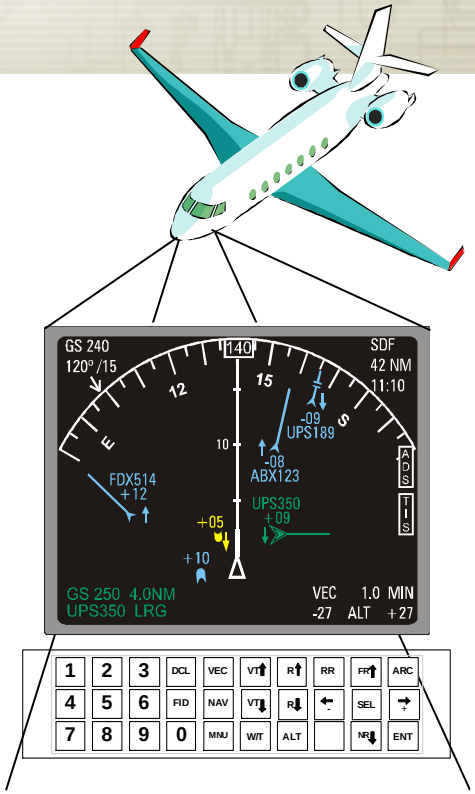
# Automatic Dependent Surveillance – Broadcast Background

- ADS-B Broadcasts are Also
  - Detected by Ground Broadcast Transceivers
  - Relayed to a Control Facility where they can be
    - Presented to Controllers
    - Distributed to Authorized Flight Monitor Personnel

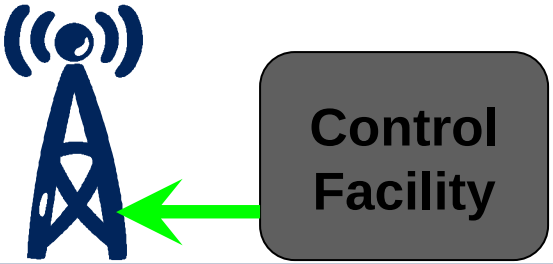


# Automatic Dependent Surveillance – Broadcast Background

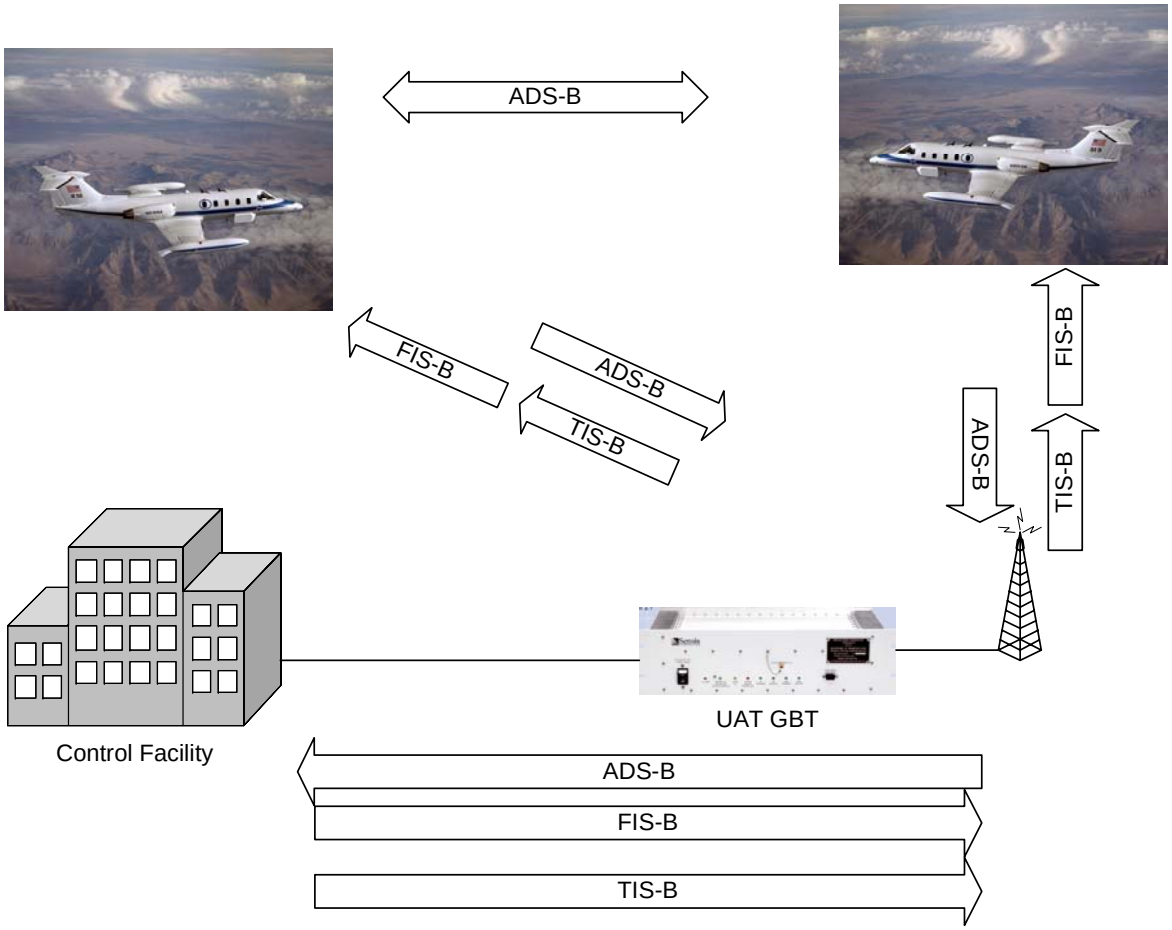
- Ground Broadcast Transceivers
  - Broadcast Traffic Information
  - Broadcast FIS-B Products
    - NEXRAD Weather
    - Generic Text Products
    - Expandable Products




MFD Showing
- ADS-B Aircraft
- TIS-B Aircraft
- NEXRAD
- FIS-B Text



# UAT ADS-B System Dataflow



# UAT WINCOMM Testing

- Utilizes existing UAT datalink
- Hardware and software modifications to support experimental capability
  - New FIS-B products uplinked
  - Air-Air and Air-Ground weather sensor data transfer

# Troposhperic Airborne Meteorological Data Reporting (TAMDAR)

- Utilizes unused bits in a specific UAT message type
- Does not cause additional message transmissions
- Transparent to Datalink
- TAMDAR data includes:
  - Temperature
  - Wind speed
  - Wind Direction
  - Humidity
  - Icing
  - Turbulence
  - Data Quality

# UAT System Changes to Support Weather Exchange

- Avionics equipment changes
  - Input TAMDAR data
  - Schedule transmission in Type 2 ADS-B message payload
  - Avionics display changes
    - Support reception and display of new weather products
- Ground Infrastructure Changes
  - Ground-Based Transceiver software changes
    - Support extracting TAMDAR data
    - Modified Ground Report to forward TAMDAR data to ground systems
  - FIS-B Server Changes to support uplink of new weather products

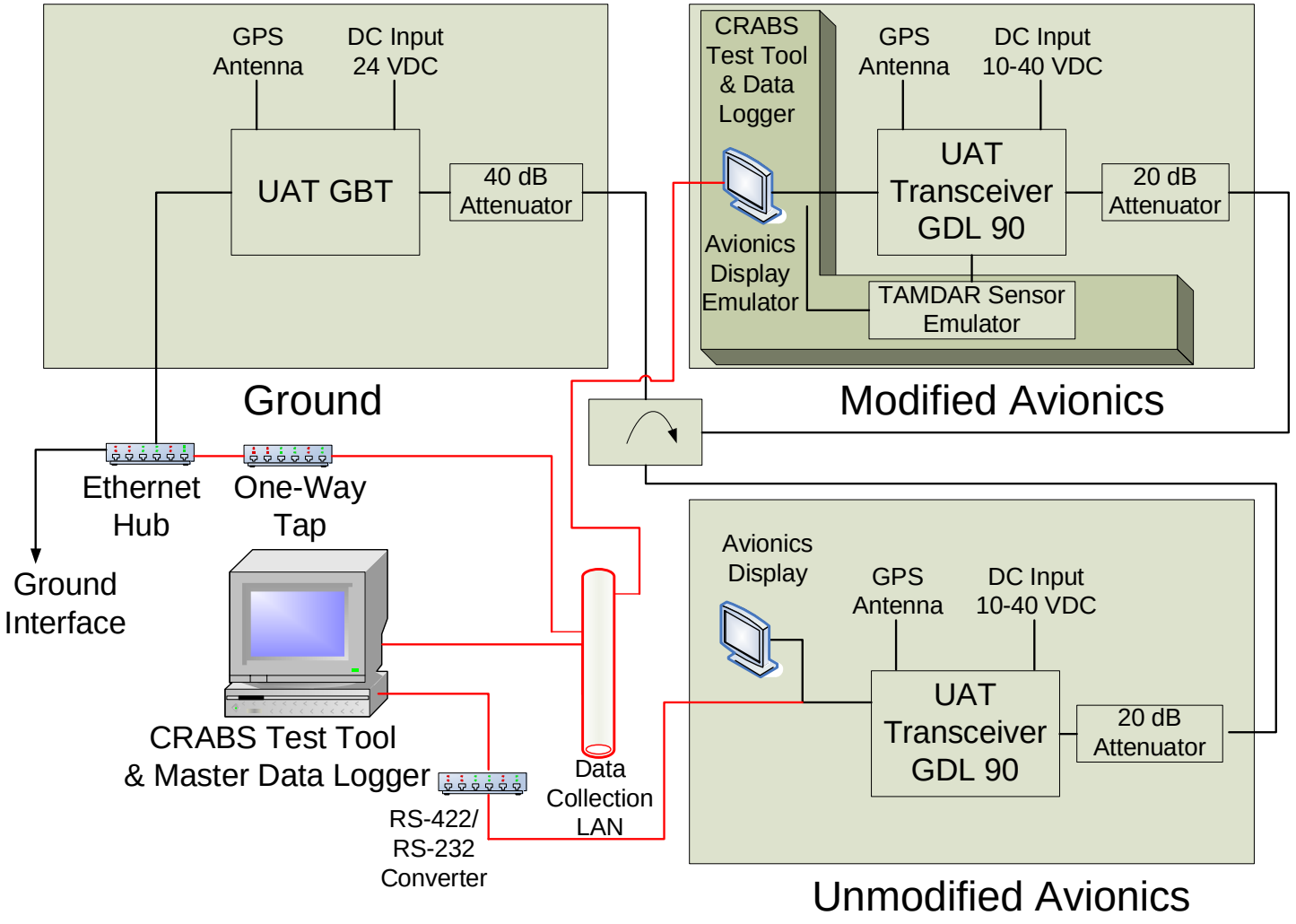
# Supporting Organizations

- The following organizations supported this effort:
  - NASA Glenn Research Center
  - FAA Safe Flight 21 Program
  - MITRE Corporation
  - Garmin International, Inc.
  - Sensis Corporation
  - JHU/APL

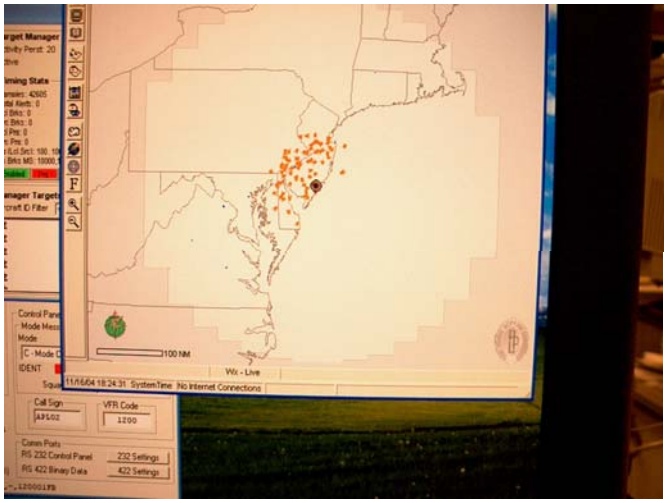
# Test Activities

- Performed laboratory testing at the FAA Technical Center in November 2004 and March 2005
  - Validated backward compatibility
  - Validated new capabilities
- Flight Check performed in April 2005 in the mid-Atlantic region
- Flight Test Activities scheduled for May and June 2005 in the Ohio region

# Test Setup


GPS Antenna
DC Input 24 VDC
UAT GBT
40 dB Attenuator
Ground
CRABS Test Tool & Data Logger
GPS Antenna
DC Input 10-40 VDC
UAT Transceiver GDL 90
20 dB Attenuator
Avionics Display Emulator
TAMDAR Sensor Emulator
Modified Avionics
Ethernet Hub
One-Way Tap
Ground Interface
CRABS Test Tool & Master Data Logger
RS-422/ RS-232 Converter
Data Collection LAN
Avionics Display
GPS Antenna
DC Input 10-40 VDC
UAT Transceiver GDL 90
20 dB Attenuator
Unmodified Avionics

# Laboratory Test Pictures




# Test Results

- Backward compatibility confirmed with both modified avionics and ground infrastructure equipment
  - No adverse effects on existing equipment
- New capabilities demonstrated
  - Air-Air and Air-Ground TAMDAR data transfer
  - New FIS-B weather products uplinked to the avionics
- Flight Check in April 2005 demonstrated new FIS-B product reception as well as TAMDAR data transfer capability
- Full Flight Test activities can be conducted with high degree of confidence

- Detailed test results are presented in the next presentation